

Date.	Degrees F.
29th.....	49°
30th.....	44°
31st.....	39°

Average Mean Temperature for the Month of October, 1904,
= 53.3°.

Average Mean Temperature for the Month of October, during
past 40 years = 55.6°.

THE PEOPLE OF THE STATE OF NEW YORK,
COMPLAINANTS,

VS.

STATE OF NEW JERSEY ET AL.

HERE FOLLOWS COMPLAINANTS' EXHIBIT No. 194.

Showing Comparison of Tests for B. Coli in Samples of Water.

JAMES D. MAHER,
Commissioner.

Report no

LEDERLE LABORATORIES

30-41 WEST 10TH STREET
NEW YORK CITY

Compliment to Mr. 194
James D. Maher
Commissioner

COMPARISON OF RESULTS OF TESTS FOR B. COLI IN SAMPLES OF WATER

WITH

RESULTS OBTAINED FROM THE EXAMINATION OF
THE SHELL LIQUOR OF OYSTERS OBTAINED FROM
SAMPLING STATIONS IN CLOSE PROXIMITY.

Taken from Table on Page 892.

28th Annual Report, Vol. II, New York State Dept. of Health.

INSIDE GREAT KILLS

	Sample Number	Approximate B. Coli Score	10 e.o.	Tests for B. Coli 1 e.o. 1 0.1 e.o. 0.01 e.o.
Water	43.1			0+ 2- 0+ 2- 5+ 2-
Oysters	134.2			0+ 5- 1 2 2 2
"	98.2	Not given		1 2+ 2- 1 2
"	133.2		3+ 2-	1+ 1- 1 2
"	94.2	14		1+ 4- 1 2
"	132.2	23		4+ 1- 1 2
"	93.2			

OFF GREAT KILLS POINT.

	Sample Number	Approximate B. Coli Score	10 e.o.	Tests for B. Coli 1 e.o. 1 0.1 e.o. 0.01 e.o.
Water	99.1			0+ 2- 1 0+ 2- 1
Oysters	130.2	5		2+ 3- 1+ 4- 1
"	99.2			2+ 3- 1+ 4- 1
"	131.2	23		4+ 1- 1+ 4- 1
"	92.2			5+ 0- 1+ 4- 1
"	137.2	26		5+ 0- 1+ 4- 1
"	96.2			5+ 0- 1+ 4- 1
"	132.2	23		5+ 0- 1+ 4- 1
"	96.2			5+ 0- 1+ 4- 1

Report no

LEDERLE LABORATORIES

39-41 WEST 36TH STREET
NEW YORK CITY

No.

52194 P 2.

SOUTH GREAT KILLS POINT.
=====

Sample Number	Approximate B. Coli Score	10 e.o.	Tests for B. Coli. 1 e.o. 0.1 e.o.	0.01 e.o.
Water	43.1		0+ 2-	0+ 2-
"	44.1		0+ 2-	0+ 2-
"	45.1		0+ 2-	0+ 2-
"	46.1	2+ 0-	0+ 2-	0+ 2-
"	49.1	1+ 1-	1+ 1-	0+ 2-
Oysters	73.8		6+ 1-	
"	142.2	28	6+ 0-	0+ 4-
"	54.2	32	4+ 2-	0+ 4-
"	156.2	14	8+ 1-	3+ 1-
"	62.2		6+ 0-	
"	161.2		6+ 0-	
"	63.2	350	6+ 0-	
"	162.2	8	6+ 0-	
"	66.2	0	6+ 0-	
"	141.2		6+ 0-	

SOUTHWEST OF GREAT KILLS
=====

Water	80.1	0+ 2-	1+ 1-	0+ 2-
"	69.1	0+ 2-	2+ 0-	0+ 2-
Oysters	66.2		6+ 0-	1+ 2-
"	167.2			
"	71.2			
"	163.2			

OFF PRINCESS BAY.
=====

Water	52.1	2+ 0-	0+ 2-	0+ 2-
Oysters	168.2		8+ 0-	2+ 0-
"	103.2			

BIDS EAST OF TOTENVILLE.
=====

Water	53.1	1+ 0-	0+ 2-	0+ 2-
Oysters	160.2		4+ 0-	1+ 2-
"	104.2		5+ 0-	

1 COMPLAINANTS' EX. No. 195. James D. Maher, Commissioner.

Weekly Report to Dr. H. D. Peabody Lederle Laboratories, on Sanitary Inspection of South Shore of Staten Island for Scalehapt Oyster System, Inc.

In order to locate private sewer outlets on the south shore of Staten Island between South Beach and Tottenville, I visited the Department of Public Works at Borough Hall, St. George, S. I. There are no maps in the Department showing these private sewer outlets.

Outlets of public sewerage system at Tottenville obtained.

In order to bring up to date locations of sewer outlets given in 1908, report of N. Y. State Board of Health, I began a sanitary inspection of the above shore.

The results of these inspections are given on following pages.

July 1st, 1910.

2

June 20, 1910.

South Beach, S. I.

There are three (3) sewers along this beach discharging into the lower bay, the outlets being located just beyond low water mark.

1. In front of Happyland entrance, 6" iron pipe, under pier, outlet 50' beyond low water mark.

2. In front of Miller's Hotel small sewer discharges under pile of rocks 20' beyond low water mark.

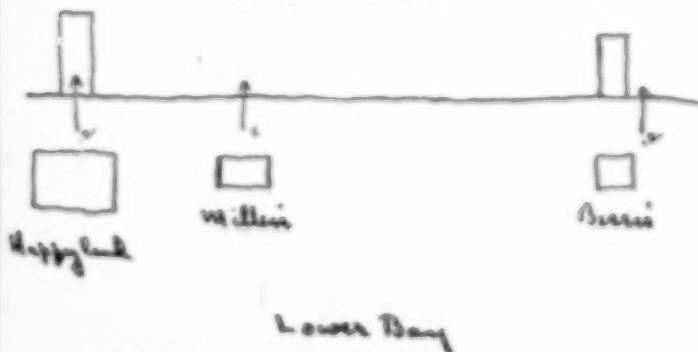
3. In front of Bessie's Hotel small sewer discharges under pile of rocks about 20' beyond low water mark.

Most of the hotels and cottages have cesspools or privies. These do not directly pollute the bay and the polluting matter is probably pretty thoroughly filtered out before the bay is reached.

There are bathing beaches along this whole shore front.

Up to the present time comparatively few people have visited the resort.

South Beach



June 21, 1910.

Visited Metropolitan Sewerage Commission of New York #17 Battery Place. Dr. Soper out. Copied Raritan Bay records of Commission.

Float Records.

Courses of floats started in the Upper Bay, or in the Hudson or East Rivers and passing out through the Narrows.

Year 1907:

Out of 12 floats passing out through the Narrows on ebb tides—
8 took a course through the Main Ship Channel East of the Hoffman and Swinburne Islands and east of West Bank light.
2 passed out along the Coney Island Channel,
2 passed to the West as far as South Beach only—
Of these one grounded on the beach, the other returned on the next tide to the Narrows.

Year 1908:

Out of the three floats passing out through the Narrows on ebb tides—
1 passed along the Main Ship Channel east of Hoffman Island
1 " " " " Coney Island Channel,
1 went to the westward as far as South Beach only.

Year 1909:

Out of 5 floats passing out through the Narrows on ebb tides—
2 passed out through Ambrose Channel
2 passed out through Coney Island Channel
1 passed out through Main Ship Channel.
There is no record of any float passing from the Narrows to the Raritan Bay Oyster grounds.

Conclusion: The courses of floats, as observed by the Metropolitan Sewerage Commission in 1907, 1908 and 1909 would indicate that the Raritan Bay oyster grounds are not directly polluted by
4 New York sewage.

Copy of Records of Water Analyses of Raritan Bay Made by Metropolitan Sewerage Commission in 1909.

This commission did not regard the presumptive or lactose bile test as sufficient evidence of the presence of B. Coli in the water and decided that it was not practicable to carry out the isolation test in each case.

They based their conclusions as to the pollution of the water at various points on the bacteria count and the percentage of dissolved oxygen saturation, combined with the results of the sanitary inspection.

The bacteria were plated out as soon as collected on the boat, on standard gelatin and grown for 48 hours. The dissolved oxygen determinations were also made on the boat as soon as the sample was collected, the A. Levy method being used.

8

JUNE 21, 1910.

Bacteria and Dissolved Oxygen in Raritan Bay Water.

Collected May 19, 1909. Low water—1:56 P. M. Wind—S. E.—10 miles per hour.

Location of Sample.	Depth.	Tide.	Bacteria per c. c.	Dis. Oxygen. % Saturation.
100' north of Old Orchard light...	1'	Ebb.	1,100	100
	10'	"	700	100
100' north of northern cable buoy.	1'	"	1,050	100
	10'	"	800	100
	20'	"	640	100
100' north of southern cable buoy.	1'	"	1,200	100
	10'	"	900	100
	20'	"	840	100
200' south of buoy S. I. W.....	1'	"	950	100
	10'	"	800	100
	20'	"	680	100
Midway between S. I. W. & Pt. Comfort	1'	"	820	100
	7'	"	740	100
500' south of buoy 11½ off Segnine Point	1'	Flood.	1,100	100
	10'	"	900	100
	15'	"	700	100
500' south of buoy N. of Segnine Point	1'	"	950	100
	10'	"	640	100
	20'	"	720	100

9

JUNE 21, 1910.

*Bacteria and Dissolved Oxygen in Raritan Bay Water.*Collected September 26, 1909. Low Water, 5:54 P. M. Wind—S. E. 40 Miles.
% Sea Water, 92. Temp. Water, 19°.

Location of sample.	Depth.	Tide.	Bacteria. per c. c.	Dis oxygen % Saturation.
300' west of buoy S. I. W.....	1'	Ebb.	500	100
	12'	"	400	100
2 miles south of Great Kills.....	1'	"	400	100
	25'	"	...	100
1½ miles south of Great Kills...	1'	"	300	100
	15'	"	300	100
1 mile south of Great Kills.....	1'	"	550	100
	10'	"	250	100

Collected Sept. 21, 1909. L. W., 6 P. M. Wind—S. E., 5 Miles.

1000' east of buoy S. E. off Seg- nine Point	1'	Flood.	120	100
	20'	"	110	100
Near buoy S. E. off Segnine Pt...	1'	"	110	100
	25'	"	160	100
1000' southeast of Princess Bay light	1'	"	190	100
	20'	"	...	100
Near Red buoy S. 6.....	1'	"	120	100
	25'	"	200	100
Near Red buoy S. 8.....	1'	"	150	100
	25'	"	320	100
500' north of Great Bedd light...	1'	"	220	100
	10'	"	410	100

4433

7

June 21, 1910.

The 1906 report of the Metropolitan Sewerage Commission states that the oyster beds in New York bay are almost exclusively located on the southeast side of Staten Island and Gravesend Bay beyond the Narrows and concludes that most of the oyster and clam beds are free from dangerous pollutions, although there are some on the Staten Island shore near the narrows and the Kill von Kull and some in Gravesend Bay, which are nearer sewer outfalls than is proper.

The results of the bacteria and dissolved oxygen tests made by the same commission in 1909 confirm the above conclusion regarding the condition of the Raritan Bay oyster beds at the present time.

The beds were not dangerously polluted at points where the samples were taken but no samples were taken at points close to the private sewer outfalls or inside the Great Kills, where the pollution is probably greater.

It is generally stated that the ebb tide coming out of the Narrows and swinging toward Raritan Bay meets the ebb from Raritan Bay at points to the northeast of Elm Tree beacon, so that the sewage discharged from New York City does not under ordinary conditions pass over the oyster grounds in Raritan Bay during ebb tide.

8

June 22, 1910.

Midland Beach.

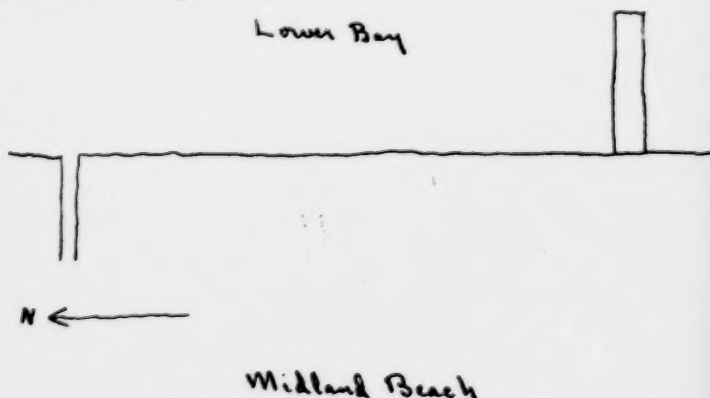
No sewers discharge directly into the lower bay at Midland Beach.

The privy system is almost universal with a few cesspools.

A few small sewers and cesspool overflow pipes discharge into trenches dug in the marshes back of the resort.

These trenches drain the mosquito-breeding swamps and eventually discharge their contents into the creek separating South Beach from Midland Beach, so that the sewage constituents may reach the bay through this creek.

1 main sewer discharges into trenches the sewage from 3 hotels and several cottages.



9

June 22, 1910.

New Dorp Beach.

There are three (3) sewers discharging into the bay along this beach.

A 6" sewer pipe discharges just beyond low water mark in front of Boehm's Picnic Grounds. The outlet is under the pier.

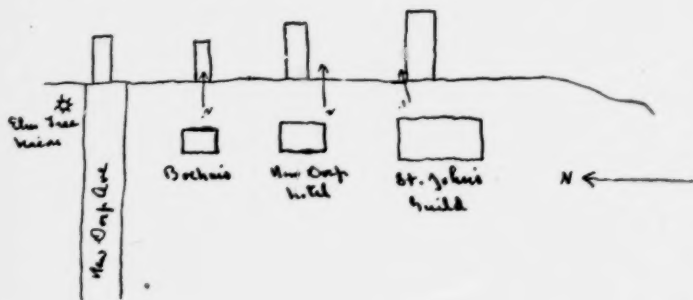
The greatest source of pollution along this beach is from the Seaside Hospital of St. John's Guild.

Just in front of the hospital beside the long pier is a 1½' sewer outlet under a pile of rocks 20' beyond low water mark.

The water contains many sewage particles especially toilet paper.

On the northern end of the bathing beach in front of the hospital there is another sewer outlet under a pile of rocks about 20' beyond low water mark.

The other hotels and private houses have privies or cesspools. None of them directly pollute the bay.



10

June 23, 1910.

Great Kills.

The chief sources of pollution of the Great Kills are three sewers and one overhanging privy.

A small sewer discharges under a pile of rocks about 30' beyond low water mark just south of Greenwadd's Hotel.

An overhanging privy in Sauer's Hotel pollutes the water the discharge being on land only at low water.

Just north of Sauer's Hotel a 2' pipe discharges just above high water mark. It drains the swamps back of the hotels and received the sewage from Collin's Hotel, the sewer pipe entering the drain near the hotel. (So informed, pipe not seen.)

Just north of Gillie's Hotel a small sewer from the hotel discharges into the Kills.

The private houses to the north of the hotel section are mostly back from the shore and are provided with privies or cesspools which do not pollute the Kills, at least directly. One (1) privy near the shore may pollute the water in case of an overflow.

The brook entering the Kills at the Yacht Club drains an ice pond.

A drain enters it which discharges dishwater from the Yacht Club kitchen. No other sewage so far as could be learned is discharged into this brook. This brook was made the subject of a sensational article on shellfish pollution in the N. Y. Journal a few years ago.

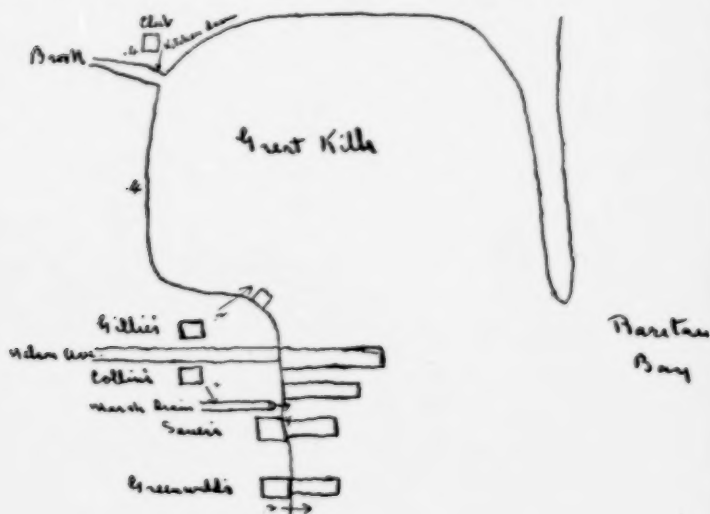
11

June 23, 1910.

Great Kills.

The Yacht Club and private houses near this brook are provided with privies, which do not pollute the Kills directly. The Yacht Club privy would in case it overflowed, or in case of a very heavy rain.

The worst spot along the Kills is just north of Sauer's Hotel near the foot of Nelson Avenue, already described.



12

Jne 27, 1910.

Eltingville Shore.

Just south of Great Kills near the foot of Seaside Avenue, Eltingville, there are about twenty (20) cottages and a fishing club near the shore.

Four (4) small sewers discharge the sewage from these houses, the outlets being under piles of rocks just beyond low water mark in three cases, and above high water mark in one cases.

The amount of discharge is very small.

Annadale Shore.

One small private sewer discharges into the bay near the foot of Poillon Lane.

Annadale Sta.

Eltingville Sta.



Princeton Bay

13

June 24, 1910.

Latourette Pond.

The Schwab Foundling Hospital discharges the sewage from 200 inmates into a septic tank. After treatment, the efficiency of which is very doubtful, from mere inspection, it is discharged into the bay at the south side of the pier near low water mark.

The overflow brook from Latourette Pond empties into the bay near this same pier. There is another overflow north of the hospital grounds. It contains no sewage.

Two hundred feet south there is an overflow into the bay from a cesspool at Brunner's Hotel. At Winter's Hotel there is a privy 50 feet back from the shore.

Hug-enot Shore.

A large hotel, 200 capacity, the Terra Marine Inn, discharges its sewage direct into the Bay by a 6" pipe. About 500 feet north of this, a wooden drain discharges sewage from a group of private houses.

Sequine Point.

The White Dental Works, 600 hands, discharges sewage from a one foot pipe at high water mark in front of the factory. Two private sewers, a one foot pipe and a 3" x 1' wooden drain, empty into Lemon Creek, near its outlet into Princess Bay.

There are two privies near the bank of creek and a one foot sewer pipe crosses the bed of the creek, heading toward Princess Bay. No outlet could be found, but pipe leaks into the creek from cracks.

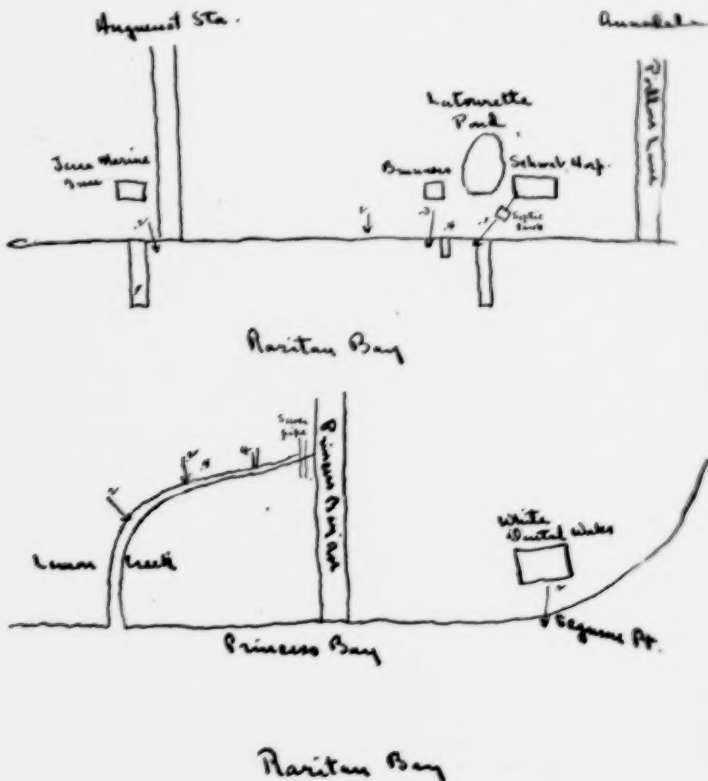
Red Bank.

The Loretto Mission, 200 inmates, discharges its sewage into the Bay at this point.

Tottenville.

Here there is a public sewer system with four outlets into 14 Arthur Kill. Two 6" pipes discharge sewage into the Kill near Perth Amboy ferry, near the large main sewer pipe.

On the Raritan Bay side of Tottenville, ten small private sewers discharge into the Bay; their combined discharge is not great.



June 25th, 1910.

Results of Inspections were plotted on U. S. C. & G. S. Chart # 120.

15

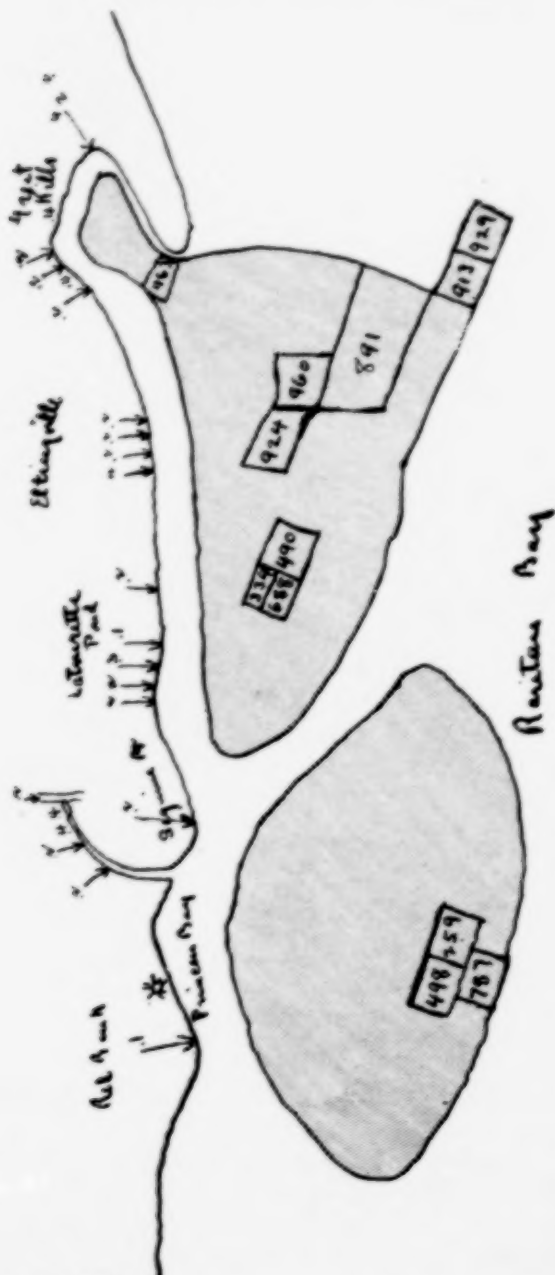
Conclusions.

Leaving out of account the Tottenville sewers discharging into Arthur Kill, which are so remote as to be comparatively unimportant, the pollution of the water of Raritan and New York lower bay- by sewers on the south shore of Staten Island is very slight. The heaviest points of discharge are at Red Bank, where the Loretto Mission is located, at Seguin Point from the White Dental Works and at New Dorp from St. Johns Guild.

Oyster beds located quite near the shore would undoubtedly feel the effect of the local sewers and this is especially true in Great Kills where some beds of other concerns are situated quite near the sewer outlets.

This shore of Staten Island is a place of summer residence almost entirely and during the chief part of the oyster season there would be very little sewage pollution with the exception of Loretto Mission and the White Dental Works.

PAYN B. PARSONS.



- 1 COMPLAINANTS' EXHIBIT No. 196. James D. Mahner, Commissioner.

Lederle Laboratories,
39-41 West 38th Street, New York City.

Report in the Matter of Testing of Oysters for the Effect of Temperature upon the Activity of the Adductor Muscle Which Controls the Opening and Closing of the Oyster Shell.

- 2 Lederle Laboratories,
Sanitary, Chemical, and Bacteriological Investigations,
39-41 West 38th Street, New York City.

Joseph A. Deghucé, Ph. D.
Frederic D. Bell.
Harry E. Bramley.
Herbert D. Pease, M. D.

September 16th, 1912.

Report.

The sample of oysters was brought to me by Mr. George W. Sanbeg on September 14, 1912, from Bed #490, off Great Kills, Staten Island. These oysters were placed in a refrigerator held at a temperature of approximately 38° F. for over night. At the same time, several gallons of sea water which were collected off the Battery, showing a specific gravity test of 10/19 were likewise placed in the refrigerator until the next morning.

On the morning of September 15, seven (7) of the oysters and two (2) quarts of sea water were placed in separate vessels in another refrigerator and were cooled to 36° F. To the two (2) quarts of the sea water there was added 1/10 of a gram of Merck's Medicinal Fuchsin and thoroughly dissolved. This fuchsin solution was then added to the 7 oysters and the vessel containing the same was allowed to stand at a temperature of from 34 to 36° F. until 6:30 P. M. The entire group of 7 oysters was then washed in brine at a temperature of 35° C. for the purpose of washing off all traces of the fuchsin solution. Three of the oysters were then opened and the shell liquor collected in a flint glass bottle. Inspection of the opened oysters failed to show the slightest traces of fuchsin coloration on the inside of the shell, on the tissues of the oyster, or in the shell liquor. The shell liquor was preserved until the morning of the 16th, for the purpose of determining by daylight whether the liquor contains the slightest tinge of fuchsin coloration.

3 It was found that it was entirely without such coloration.
A fresh solution of fuchsin in 2 quarts of sea water of the same concentration was made, and the remaining 4 oysters of the 7 orig-

inally taken, were placed in this solution and left at room temperature. They were allowed to remain in this solution for a period of 22 hours at an average temperature of 65° F. At the end of that time, the oysters were opened and the following results noted: The gills of the oyster were turned a dark fuchsin color, the mantles were slightly discolored on the inner surfaces, the body of the oyster was not colored with the fuchsin to any extent. On opening the oysters, the shell liquor was found to be comparatively free from color. The inner surfaces of the shell were also uncolored.

Interpretation.

The results of this investigation would demonstrate that oyster kept in water at a temperature of 34 to 36° F. will remain closed, and that even water soluble dyes in solution of sea water fail to gain entrance to the cavities of the oyster inside of the shell. As the particles of these dyes in aqueous solution are infinitely smaller than the bodies of bacteria, it would be a warranted conclusion that the complete closure of the shell, such as occurs at this temperature, would be the means of total exclusion of the bacteria in the water surrounding the shell gaining entrance to the oyster inside of the shell.

THE PEOPLE OF THE STATE OF NEW YORK,
COMPLAINANTS,

VS.

STATE OF NEW JERSEY ET AL.

HERE FOLLOWS COMPLAINANTS' EXHIBIT No. 197.

Showing Report of Copper in Oysters.

JAMES D. MAHER,
Commissioner.

FEDERLE LABORATORIES
32-47 WEST 32ND STREET
NEW YORK CITY

*Complaints Exhibit No. 149
James D. Maher
Commissioner*

REPORT
In the matter of

COTTON IN JEWELRY

RESULTS OF TESTS FOR COPPER.

(IN TABULATED FORM)



LEDERLE LABORATORIES

39-41 WEST 38th STREET

NEW YORK CITY

No. _____

Ex. 197-P.2

COPPER IN OYSTERS.

Lab. No.	Sec.	Location of Bed.	Percent of Copper	Weight of Copper per Oyster in mg.	Average Weight of Oysters in Gm.	Mg. per kilogram of Copper per Oyster	Color of Oysters	E. Coli Numer Value	Remarks
60,762	15	L.I. Sound - Duplicate Exam. by Boths	.0107	1.00	9.65	107	All slightly green		
60,480	16	Narragansett bay - Hides Hole	.0083	1.65	19.538	83	All five white	0	
60,481	16	" " - Mt. Hope bay	.0125	2.04	16.246	125	" " "	4	
60,482	15	Long Island Sound - Spindle ground	.0782	6.40	8.175	782	All five very green	0	
60,483	15	" " " - Red #8	.0558	5.00	8.958	558	" " " "	3	
60,562	14	Princess bay #1 - Shipped to Cal. & returned	.0211	2.94	13.959	211	All five traces of green		
60,563	14	" " #2 - " " " " "	.0240	3.64	15.146	240	" " " " "		
60,576	20	San Francisco canned oysters - Bear brand	.0295	2.80	9.497	295	All five white	21,000	Shucked
60,577	20	" " " " - Antler brand	.0081	0.60	9.840	81	" " "	3	"
60,578	20	" " " " - Eagle brand	.0098	1.42	14.500	98	" " "	1-	"
60,579	20	Toke Point, Washington	.0080	1.10	13.793	80	" " "	41	
60,580	20	Shoal bay, California	.0086	0.15	1.706	86	" " "	140	
60,678	16	Narragansett bay, Quonset Point	.0087	1.14	13.064	87	" " "	6	
60,679	16	" " Rumatick Point	.0155	2.20	13.933	155	" " "	0	
61,359	14	Princess bay	.0219	3.80	17.324	219	" " "	1	
61,330	14	" "	.0394	7.10	18.008	394	All seven very green	5	
61,404	18	Wisomoko river	.0025	0.24	9.755	25	All five white	0	
61,405	18	Chesapeake bay, Poplar Island	.0046	0.52	11.374	46	" " "	3	
61,407	18	Potomac river	.0074	0.66	8.948	74	" " "	1	
61,408	18	Chesapeake bay	.0074	0.76	10.674	74	" " "	4	
61,410	18	James River	.0091	0.84	9.321	91	" " "	4	
61,412	18	Choptank river	.0076	0.72	9.440	76	" " "	4	
61,414	18	" "	.0036	0.24	6.535	36	" " "	4	
61,416	18	Seyvern river	.0091	0.60	8.795	91	" " "	2	
61,424	18	Potomac river	.0072	0.78	10.979	72	" " "	1	
61,425	18	Pocomoke sound, Chesapeake bay	.0027	0.35	13.081	27	" " "	14	
61,426	18	Potomac river	.0041	0.64	15.598	41	" " "	5	
61,427	18	Chesapeake bay, Tangier sound	.0022	0.18	6.337	22	" " "	3	
61,428	18	Pocomoke sound, Chesapeake bay	.0027	0.50	18.180	27	" " "	2	
61,429	18	Tangier sound. " " (Clams)	.0002	0.04	16.899	2	" " "	0	
61,430	18	" " " "	.0011	0.14	12.812	11	" " "	1	
61,431	18	Fishing bay	.0038	0.38	9.951	38	" " "	2	

Report re

LEDERLE LABORATORIES

No. 2

Ex 197-P3

Express in Quarters.

39-41 WEST 30th STREET

NEW YORK CITY

Lab. No.	Sec.	Location of Beds.	Percent of Copper	Weight of Copper per Oyster in mg.	Average Weight of Oysters in Gm.	Mg. per kilogram of Copper per Oyster	Color of Oysters	B. Coli Numer. Value	Remarks
61,460	18	Wachapreague Inlet. West bed	.0039	0.67	17.018	39	All five white		
61,465	16	Matomkin bay	.0019	0.33	17.837	19	" " "	0	
61,466	16	" "	.0007	0.12	17.47	7	" " "	1	
61,467	18	Wachapreague Inlet	.0024	0.30	12.593	24	" " "	0	
61,468	16	" "	Lost	---	---		" " "	1	
61,469	18	" "	.0035	0.30	8.668	35	" " "	0	
61,470	18	Wachapreague Inlet	.0028	0.40	14.126	28	" " "	1	
61,471	18	" "	.0023	0.37	15.894	23	" " "	2	
61,477	16	James River	.0060	0.84	13.914	60	" " "	3	
61,625	18	Potomac River	.0025	0.40	16.2811	25	" " "	4	
61,695	11	Great Mouth Bay	.0043	0.54	12.519	43	" " "	0	
61,696	11	" " "	.0036	0.46	12.154	36	" " "	0	
61,697	11	" " "	.0036	0.64	17.856	36	" " "	0	
61,757	11	" " "	.0045	0.80	17.963	45	" " "	3	
61,758	18	Maddox Creek, br. of Potomac	.0063	0.94	14.944	63	" " "	14	
61,759	18	Potomac river. Finney Point	.0033	0.36	10.846	33	" " "	4	
61,760	18	Fishing bay. Chesapeake bay	.0023	0.26	11.760	23	" " "	2	
61,761	18	Nanticoke river	.0061	0.80	9.827	61	" " "	4	
61,762	18	Chesapeake bay	.0049	0.72	14.737	49	" " "	300	Shucked
61,763	18	" "	.0040	0.76	15.770	40	" " "	300	"
61,862	17	Upper N. Y. Bay. Robbins Reef	.0227	2.96	13.057	227	Four white. One traces of green.	14	
61,863	17	" " " Oyster Is.	.0234	3.72	14.177	234	One white. Three traces of green and One very green.	41	
62,041	14	Princess bay	.0129	2.00	15.498	129	All five traces of green.		
62,042	14	" "	.0707	11.60	16.403	707	All five very green.		
62,210	21	Malpeque	.0032	0.30	9.262	32	All five white.	0	
62,292	18	York River	.0037	0.50	13.558	37	Four white. One traces of green.	3	
62,456	13	Jamaica bay. Bed 84	.0057	0.62	10.680	57	All five white.	2	
62,467	13	" " Bed 158	.0064	1.00	15.731	64	Four white. One traces of green on mantle.	4	
63,148	25	Best Dutch	.0002			9	All five white.	140	
63,150	25	Third Dutch	.0029			29	" " "	50	
63,151	24	Best Whitatables. English.	.0002			2	" " "	23	
63,154	24	Best Burnhams. English.	.0027			27	" " "	140	
63,155	24	Second Burnhams. English.	trace			--	" " "	41	

Ex. 197-P. 4

Report 10

LEDERLE LABORATORIES

39-41 WEST 38th STREET

NEW YORK CITY

No. _____

SUMMARY.

Average percent of copper in oysters not showing green coloration
(51 samples - 255 oysters) - .0049

Average percent of copper in green oysters. (8 samples - 40 oysters) - .0391

Range of percent of copper in oysters not showing green coloration - .0295 to .0002

Range of percent of copper in green oysters - .0782 to .0107

Mg. per kilogram of copper

Average for oysters not showing green colorations	-	49
Average for green oysters	-	391

Range of copper in Mg. per kilogram of copper

In oysters not showing green colorations	-	295 to	2
In green oysters -	-	782 to	107

Location of beds for which greenest oysters came -
Long Island Sound - Spindle ground, south of Sheffield Island,
4 miles off South Norwalk, Conn.

1 PART OF COMPLAINANTS' EXHIBIT 198. (See page 11.)
James D. Maher, Commissioner.

U. S. Department of Agriculture, Weather Bureau, New York, N. Y.

Annual Meteorological Summary, 1912, with Comparative Data.

Published by authority of Willis L. Moore, Chief U. S. Weather Bureau. Compiled under the direction of James H. Scarr, District Forecaster.

Published by local office, U. S. Weather Bureau, New York, N. Y.

* * * * *

11

Wind Direction.

Monthly and Annual Percentage from—(Period 1894 to 1903, Inclusive.)

Month.	N.	N. E.	E.	S. E.	S.	S. W.	W.	N. W.	Calm.
January	8	13	6	4	6	15	18	30	0
February	7	12	5	4	6	12	19	33	0
March	9	12	9	9	10	10	12	29	0
April	9	14	8	12	10	10	11	27	0
May	7	12	10	14	14	15	11	17	0
June	5	8	9	13	17	18	11	19	0
July	5	9	6	10	19	24	12	16	0
August	8	10	7	12	16	17	11	17	0
September	8	13	6	10	16	17	10	20	0
October	9	16	8	7	10	16	12	22	0
November	7	12	5	4	9	16	17	29	0
December	10	11	5	4	8	18	19	26	0
Year	8	12	7	9	12	15	14	24	0
	*	*	*	*	*	*	*	*	

1 COMPLAINANT'S EXHIBIT 199. James D. Maher, Commissioner.

7 *Disposal of Sewage.*

This has been a most difficult problem and has been considered by committees of our boards, by civic bodies and by committees of citizens. We have had the opinion of the best experts on the subject. One point is conceded and that is no matter what system of sewage disposal is adopted Paterson must change from a combined to a separate system of sewers. For a year, at my direction, the City Engineer has been studying this question and worked out a plan by which we will be enabled to change our system for a great deal less than was first thought possible. The sewers built for the last two years have kept this plan in view.

The plan of the City Engineer for a separate system, which accompanies this message, should be adopted and put into operation. This can be done gradually and without being too great a burden.

Heretofore, the Lakeview section of the City has been neglected. At my direction, the City Engineer has prepared a plan for sewerage this section, the development of which has been hindered by the lack of this necessary provision. A system could be extended through this section at a reasonable cost. The main trunk could be built for about \$25,000, part of which could be assessed upon adjoining property, leaving probably from ten to fifteen thousand dollars to be raised by sale of bonds.

The Stony Road section is hindered by a like lack of sewage facilities, and the Engineer should be instructed to work out a plan for the sewage of that section.

The main question of disposal of the sewage has not been decided. If a trunk sewer can be built for the money reported by the Sewage Commission, and permission can be had to empty the same into New York Bay without purification works, then Paterson should join in the plan. If the sewage must be purified, as we have every reason to believe, then there is no reason for extending the sewer to New York Bay. The great expense of a tunnel to New York Bay should be avoided and the purification works built on Newark meadows.

Paterson will maintain the position that no matter what plan is adopted this City will not enter into any final contract with the Commission until the exact cost is ascertained by bids from reputable contracting firms.

8 Engineering works of this kind are generally estimated to cost considerably less than the final actual cost. We should be sure that the trunk sewer plan will cost us no more than a separate disposal works.

If the present financial management of the City is continued the City will be able to assume the burden of this problem without great detriment.

The likelihood of this burden being cast upon us has ever been uppermost in the minds of the Finance Commission and myself and makes it necessary that even stricter economy be practiced in the future in order to prepare for the shock which the assumption of the debt and expense of sewage disposal will cause the City.

COMPLAINANTS' EXHIBIT No. 200. James D. Maher, Commissioner.

NEW YORK CITY, May 19th, 1913.

This certifies that a copy of the within report has been filed in the Mayor's office by the Metropolitan Sewerage Commission.

JAMES MATTHEWS,
Executive Secretary.

Preliminary Reports on the Disposal of New York Sewage.

IV.

Study of the Collection and Disposal of the Sewage of the Upper East River and Harlem Division.*

Metropolitan Sewerage Commission of New York.

George A. Soper, James H. Fuertes, H. de B. Parsons, Charles Sooy-Smith, Linsly R. Williams, Commissioners.

July, 1912.

1 *Study of the Collection and Disposal of the Sewage of the Upper East River and Harlem Division.*

Honorable William J. Gaynor, Mayor of the City of New York.

SIR: In Preliminary Report No. 1, dated September, 1911, the Metropolitan Sewerage Commission divided the territory covered by the City of New York into four parts to facilitate the design of main drainage works for the protection of the harbor against excessive sewage pollution. The works for the Jamaica Bay Division, one of these parts, were described in a report dated December, 1911. The present report deals with a general plan for main drainage and sewage disposal for a second part, known as the Upper East River and Harlem Division, which embraces the land in the Boroughs of the Bronx and Manhattan, which drains to the Harlem river, and the land in the Boroughs of the Bronx and Northern Queens which drains to the Upper East river.

The plan here set forth is the result of careful study based on the outlook in the year 1912 for the municipal development of the region under consideration and on the existing state of the art of sewage disposal.

All the work planned will not be required in the immediate future, but it is regarded as necessary that such main drainage work as is undertaken by the city should conform to these plans, or such modifications of them as may be determined upon. The possibility

*This report is issued in advance of the final report of the Metropolitan Sewerage Commission in order that the contents may be of early service. Some features of this report will remain open for revision until the final report is submitted.

that a more complete system of main drainage than is here proposed may be needed in the distant future has been kept in mind in preparing these plans and it is believed that the works can be economically adapted to afford a more thorough protection of the harbor in the case of necessity.

The most prominent feature of the plan is the discharge of the sewage, after partial purification, into the large, deep tidal channels as near the sound entrance of the harbor as practicable.

The works are intended to deal with the dry-weather flow of sewage as collected in the lateral sewerage systems now built on the combined system. Where no sewers have yet been constructed, it will generally be desirable to build them on the separate system; this will not only facilitate a removal of the impurities, but contribute to economy of construction.

Topographical Features of the Division.

The Harlem river and the Upper East river determine the principal topographical features of this division. The Harlem river runs through a narrow valley with shores which are in part densely populated, or are certain to become so at no distant day. The shores of the Harlem are nearly parallel, the stream resembling, in some respects, and being actually in part, a canal. The water is already so overburdened with sewage that no system of diffusion or other partial remedy is capable of sufficiently improving it. There is not room on the drainage area of the Harlem for purification works capable of sufficiently improving the sewage to permit of its discharge into these waters, and consequently the sewage must be taken elsewhere.

The shore lines on both sides of the Upper East river are markedly irregular; the water surface being characterized by a series of large, shallow bays along the whole length, separated by long, narrow points of land.

The water in the main channel which flows through the Upper East river is not now overburdened with sewage, nor is it likely soon to become so. It has a large capacity for assimilating sewage provided the sewage is properly treated and then discharged directly at the bottom of the tidal stream.

The parts of this territory which present difficulties to main drainage are chiefly flat, low-lying valleys which extend long distances inland from the shallow bays of the river.

Except in the closely built-up part of this division, which is, or will be, tributary to the Harlem river, the population in the territory included in this report is chiefly of a semi-rural residential character, located in numerous growing villages not largely devoted to manufacturing. The future of this division seems to lie in its more complete occupation for residential purposes. The configuration of the shore, the shallowness of the water, except in the main channels, and the distance from the metropolitan centers of commercial activity are opposed to the extensive development of this section for the uses of manufacturing and transportation.

Bathing beaches, camps and other provisions for recreation at moderate expense during the summer months are now more or less numerous and seem destined to increase in popularity unless the pollution of the harbor water should become so great as to be too objectionable.

Formerly shellfish of excellent quality were gathered in large numbers in the Upper East river, and even at the present time hard-shelled clams are dredged near where the river joins Long Island Sound. Except for small boats, yachting, which was, and is, enjoyed by many persons in the Upper East river, has, for the most part sought Long Island Sound for the clearer water, lesser tidal currents and greater freedom from traffic which there prevail.

3 Separation of the Division Into Five Parts for Main Drainage Purposes.

To facilitate the sewerage and drainage of the Upper East river and Harlem division the entire territory has been separated in this report into five sub-divisions.

In each sub-division the sewage is to be collected to a central point for treatment and discharge. The boundaries of the five sub-divisions follow:

1. The Harlem Sub-division comprises the land in the Borough of Manhattan, north of 82d Street, naturally draining to the Harlem river, and that part of the Borough of the Bronx lying west of the Bronx river, except a narrow strip draining to the Hudson river.
2. The Eastern Bronx Sub-division comprises that part of the Borough of the Bronx which lies east of the Bronx river. Westchester, Unionport and Van Nest are situated within this area.
3. The Northwestern Queens Sub-division comprises the northwestern part of the Borough of Queens, draining mostly to Bowery bay and to the westerly shore of Flushing bay, and includes North Beach, Woodside, Steinway and a part of Corona.
4. The Corona-Flushing Sub-division comprises that portion of the Borough of Queens, tributary to the East river, which extends from the southeastern boundary of sub-division 3 southerly to the main divide of Long Island and easterly to a line running through Whitestone and Inglewood. Most of this area lies in the Flushing creek drainage basin. Winfield, Elmhurst, Corona, Flushing and College Point and parts of Whitestone are situated within its limits.
5. The Northwestern Queens Sub-division comprises that part of the Borough of Queens, tributary to the East river and Little Neck bay, which lies east of the limits of sub-division 4. Douglaston, Bayside and parts of Whitestone are included in this area.

Points for Concentration and Discharge of the Sewage.

The sewage will be collected to as many points as there are sub-divisions.

The sewage of the Harlem Sub-division is to be carried to Ward's Island, where it is to be treated and the effluent discharged into the swift currents of Hell Gate.

4 The sewage of the Eastern Bronx Sub-division will be collected near Clason Point, where, after treatment, it will be discharged into the deep water of the Upper East river.

The sewage of the Northwestern Queens Sub-division will be carried to a point in the neighborhood of Hell Gate and there discharged.

The sewage of the Corona Flushing Sub-division will be brought to Tallman Island, where treatment works can be located. The sewage will be discharged into the East river under conditions favorable for diffusion.

The sewage of the Northeastern Queens Sub-division will be carried to Crysler's Point, just west of Little Bay and opposite Throgs Neck. There the sewage can be discharged into deep water at the extreme east end of the East river.

Methods of Treatment.

NOTE.—The methods which are proposed in this report for treating the sewage are such as have been thoroughly tested and found by the experience of many cities to give good results, while not designed to afford a high degree of purification, the processes are among the most reliable, least offensive and most economically known, and are believed to be capable of removing the impurities of the sewage to such an extent as to permit of the effluent being discharged into the harbor under suitable conditions without offense.

Eventually the growth of population and the consequent increase in the quantity of sewage produced probably will require that more complete methods of treatment shall be employed, or that the sewage shall be taken to some other place for disposal. It is impossible to foretell with accuracy when that time will arrive, but the Commission is of opinion that the works now planned will afford all the protection which the harbor will require for the next forty years, or until about 1952. As to the methods of treatment which ultimately will be needed, it is equally difficult to prophesy; the art of sewage purification has by no means reached perfection, and if the progress of the next forty years equals the accomplishments of the last twenty, a not unreasonable anticipation, marked improvement may be expected in the efficiency, economy and reliability of existing methods, if not the introduction of new processes, which will be revolutionary in character.

The probability that it ultimately will be necessary to protect the harbor against sewage to a greater extent than the requirements of the present or discoverable future require has been clearly recognized by this Commission from the first and has been kept in mind in making the plans here proposed with the object that these works might form part of a more comprehensive scheme of dealing with the sewage when that becomes necessary.

Methods of Treatment Proposed.—After a careful study of the question of the form of treatment required for the sewage of the Upper East river and Harlem Division, due regard being had to the needs of each of the five outlets, the conclusion has been reached

that fine screening or coarse screening and sedimentation will, for some years, give an effluent of satisfactory character for discharge into the water of the East river.

Where sedimentation tanks are to be used, coarse screens will be employed to protect the pumping machinery and to keep large floating matters from causing trouble in the tanks and from passing out through the outfall.

5 In all cases grit chambers will be placed on the lines of the main trunk sewers at or near the treatment works. In these chambers the sewage will be given a settling period of from one to two minutes, the velocity being reduced sufficiently to allow the heavy mineral detritus borne by the sewage to be deposited, but not enough to permit much organic matter to settle.

The grit chambers will afford protection to the pumps and will keep the proposed long and deep outfall pipes clear of gritty deposits wherever sedimentation tanks are not used. Where sedimentation tanks are planned, the grit chambers will first rid the sewage of suspended matter of a kind which would cause trouble and be difficult to handle if allowed to settle in the tanks. Grit chambers are especially useful where combined sewers are intercepted or form a part of the collecting system, as will largely be the case with the main drainage systems as here proposed for New York City.

The treatment works at Ward's Island, Clason Point and Tallman Island, for the Harlem, Eastern Bronx and Corona-Flushing Sub-divisions, respectively, should consist of grit chambers, coarse screens and settling tanks. Fine screens and grit chambers at the foot of Winthrop Avenue, Long Island City, will suffice for the treatment of the sewage for the Northwestern Queens Sub-division; the sewage from the Northeastern Queens Sub-division should be passed through grit chambers and fine screens at Cryder's Point, Beechurst.

If it were deemed necessary to purify the sewage from the Harlem Sub-division to a greater extent than would be done by sedimentation or chemical precipitation, it is doubtful if its further purification could undertaken either at Ward's Island or at any other place in the vicinity. The area of land required for percolating filters, to treat the large volume of sewage which is to be brought to Ward's Island, would require more land than is available, and the odors which might be produced by their use would be objectionable in this location.

The amount of sewage to be discharged from Queens into the East river at Winthrop Avenue, although large in the distant future, will, for many years, be considerably less than the quantity brought to Tallman Island. It will never be more than a small proportion of the amount to be discharged into the river from the Ward's Island sedimentation plant, only a few hundred feet distant from Winthrop Avenue. In view of this fact, screening is the only form of treatment deemed necessary for the sewage of the Northwestern Queens Sub-division. If a more thorough treatment be needed in the future, when the volume of sewage becomes greater, it will be possible to carry the sewage by means of a tunnel under the East river to the disposal works at Ward's Island; or the necessary land

for a pumping station and settling tanks may be procured in the Borough of Queens.

6 The amount of sewage to be discharged at Cryder's Point probably will always be comparatively small and the opportunity for its diffusion and digestion in the waters of the East river is favorable; therefore screening is the only treatment required for the sewage of the Northeastern Queens Sub-division.

Sites for Treatment of Works.

Harlem Sub-division.—After considering many projects for the collection and disposal of the sewage of this sub-division it becomes evident that it would be uneconomical to take the sewage further from Hell Gate, provided a suitable site for treatment works could be found in that vicinity.

For a time it seemed likely that Riker's Island might offer every necessary facility for the disposal of the sewage, not only of the Harlem, but of most of the other sub-divisions. The area of Riker's Island is large enough for any works which might be needed, the situation is remote from inhabited shores and the island, as yet but little occupied, already belongs to the City.

Upon investigation, Riker's Island was found to be unsuitable as a site for sewage disposal works. Composed of uncompacted refuse from New York City, the stability of the island is too uncertain to warrant the construction of the extensive engineering works required, and large sums of money would have to be spent for grading in order to save the excessive cost of pumping the large volume of sewage to the present level of the island.

The island known as Sunken Meadow was examined, but was found to require too much improvement to warrant its use as a location for sewage disposal works.

A better and a satisfactory location for the works required lies at the northeast corner of Ward's Island. This island is more favorably located than Riker's Island in respect to the economical collection of the sewage, and the land at the proposed site is low, firm and of sufficient extent for such works as will be required. The island belongs to the City of New York and is partly occupied by public institutions. No injury would be done by employing the corner selected for treatment works. Deep water lies close to the island; the shore is smooth and the currents are swift. The opportunities for an immediate diffusion of the sewage in the water are perhaps better at this place than at any other point in the whole metropolitan district, owing to the mixing action of the currents.

Eastern Bronx Sub-division.—Two large areas of marsh land, southwest and southeast of Unionport, were at first considered as sites for sewage disposal works, each being of ample size, but both situated far from deep water. A more favorable site for the location of such disposal works as will be needed for this sub-division exists near Clason Point, where the ground is low and firm, and the deep and swift currents of the main channel of the Upper East river pass near the shore. A large part of the sewage from this sub-division will be brought to Clason Point by the drainage system now

under construction, and the remainder can be collected at low cost.

Northwestern Queens Sub-division.—Most of the land in the Northwestern Queens Sub-division drains naturally to Flushing and Bowery bays, but owing to the shallow water and absence of currents capable of mixing with the sewage and carrying it away, there is no point in either bay where large quantities of treated sewage should be discharged. The nearest suitable point for the discharge of the sewage, after the removal of the suspended matter, is Hell Gate, near the foot of Winthrop Avenue, and directly opposite the proposed Ward's Island treatment works. The volume of sewage to reach this place probably will be small for many years, and such land as is needed for the simple treatment required can be procured without great difficulty or expense.

Corona-Flushing Sub-division.—A large proportion of the sewage of the Corona-Flushing Sub-division can easily be concentrated near the mouth of Flushing creek and the rest can be collected by a sewer running from that point to Tallman Island, where treatment works should be located.

Tallman Island is the nearest point to the mouth of Flushing creek at which treatment works, of a kind requiring the discharge of the effluent into deep water and swift currents, can satisfactorily be placed. Both land and water conditions are suitable at this point for the location of disposal works and the discharge of the effluent. The site is practically devoid of improvement and little or no injury will be caused to future development by such works as are proposed. Deep water exists at a short distance from shore, and the volume and character of water flowing past this point are favorable for the digestion of a large quantity of sewage.

The comparative ease with which the sewage from that part of the Flushing Creek Sub-division which lies west of the creek, can be united with that from the neighborhood of Flushing and brought to Tallman Island, makes it desirable that such disposition of the sewage should be made. The sewage should not be carried to Hell Gate, for this would be more expensive and increase the burden which the water of the East river has to bear near the densely populated districts of the city.

8 Northeastern Queens Sub-division.—The only practicable place for the discharge of the sewage of the Northeastern Queens Sub-division, unless intensive treatment be employed, is the East river, between Whitestone Point and Cryder's Point. The latter is the more suitable place both for the collection and the discharge of the sewage. The East river offers better opportunities for the reception of sewage off Cryder's Point than it offers at Tallman Island or Clason Point. As the amount of sewage will probably be comparatively small, for at least a great many years, and the conditions for the digestion of the discharged sewage by the water are favorable, fine screening is the only treatment deemed necessary at this point. There should be no objection to the presence of a screening plant, provided the appearance of the building conforms with the surrounding development.

Instead of carrying the sewage of Bayside and Douglaston to Cryder's Point, as is here proposed, it is possible to treat it on per-

colating filters which can be built on the marshes near Alley creek, but as these might be objectionable to the residents of the neighborhood, the plan is not considered advisable.

Outlets.

Location and Depth.—The sewage will be discharged in every case at a distance from the shore, the position of the outfall depending upon the nearest point at which water of suitable depth can be found. It is proposed always to have the sewage discharged at depths of from 30 to 50 feet, and in such manner as to give a favorable opportunity for its admixture with the water of the river. In order to facilitate diffusion, it will be desirable to discharge the sewage from each point at more than one outlet.

Systems of Main Drainage.

Character of Sewers Proposed.—The main collecting and intercepting sewers, as planned by the commission for the Harlem, Eastern Bronx and Northwestern Queens Sub-division, will carry only the dry-weather flow of the contributing combined sewers, already built or to be built, in these districts. They are not designed to carry any portion of the storm flow. Overflows from these main dry weather sewers will allow the storm water to pass directly to the water courses. The commission does not believe that, in this district at least, the advantage gained by the treatment of the storm water, at the works proposed would warrant the extra expense involved in that procedure.

9 The main collecting and intercepting sewers, planned by the commission for the Corona-Flushing and Northeastern Queens Sub-divisions, will carry only house sewage. In these areas it is especially desirable that all new sewers be built on the separate system. Throughout this territory, few sewers of any kind have as yet been built. Practically the only combined sewers are in the villages of Flushing, Ingleaside, College Point and Whitestone. The commission's plans and estimates for main drainage systems in those two sub-divisions have been made so as to utilize the existing sewers as far as practicable, and on the assumption that the dry weather flow from the existing combined sewers would be intercepted but that all sewers hereafter built tributary to these systems would carry only house sewage.

Relative Merits of Separate and Combined Sewers.—Although this commission is aware that the Board of Estimate and Apportionment of the City has approved preliminary drainage plans prepared by the Sewer Bureau of Queens Borough for a large portion of the Corona-Flushing Sub-division, and that these plans call for combined sewers, except in the low lands where the street grades to be established make combined sewers impracticable, discharging into Bowery bay all the sewage originating west of Flushing creek, the commission believes it to be desirable to provide more protection than these plans afford for keeping the waters free from sewage.

In the judgment of the commission, the character of the territory and of the neighboring waters make separate, instead of combined, sewers generally advisable for the Corona-Flushing and Northeastern

Queens Sub-divisions. Although the growth of population in many parts of this large area has been rapid, and with the extension and betterment of transit facilities is likely to be still more rapid in future, the total population at present is relatively small, and most of it is gathered into a number of more or less isolated residential communities. Large areas of unoccupied land exist. Notwithstanding the probable increase in population, the several communities may be expected to preserve their separate identities for many years. In these villages there probably will be only comparatively few parts which, in the near future, will support a dense population. Only small portions of the territory will need complete systems of drains for the removal of storm water. If the house sewage is removed by means of separate sewers, these can be of small size in comparison with those that would be necessary in case storm water were also to be provided for in the same system, whereas the surface water may, in many cases, be discharged into near-by water courses, such as Flushing creek, without harmful consequences. Separate sewers can thus be made to save for the present the cost of constructing the large and long storm water drains that will be necessary when the land around these creeks is fully developed. The construction of some of these long main drains can be undertaken gradually, as the need for them becomes evident through the development of the territory.

Practically all the unsewered communities in the Corona-Flushing Sub-division are in need of sewers for the removal of household wastes. But if the house sewage from these comparatively small and isolated centers of population were to be collected and carried away in combined sewers enough to take care of the storm water drainage of the districts when they shall have become densely built up in the future, not only will the present per capita cost of construction be unnecessarily high, but also the small dry weather flow in the large sewers will cause deposits to form on their bottoms, give rise to septic conditions and make a high cost for maintenance.

It would be inadvisable to recommend the installation of separate sewers in the Harlem Sub-division, as the population is practically all served at present by combined sewers, and future extensions of the same character have been planned to such an extent as to make a recommendation to this effect unwise.

In the Eastern Bronx Sub-division, also, the installation of separate sewers would not be warranted, as much of the drainage system is already under construction, and comparatively little additional work is necessary in order to bring all the sewage of the district to Clason Point.

Although the separate system would be well adapted to such a development of the land as may be expected in the Northwestern Queens Sub-division for many years, and would also serve better to protect Bowery bay from pollution during periods of storm, certain considerations make the separate system inadvisable in this territory. The treatment which is projected for the sewage in the near future is passage through grit chambers and screens. At some future time many parts of this territory are likely to be occupied by a rather dense population. Moreover, preliminary plans, contemplating the installation of combined sewers, have already been made by the

Bureau of Sewers of the Borough of Queens and approved by the Board of Estimate and Apportionment.

Collecting Sewers for the Harlem Sub-division.—The sewage of the Harlem Sub-division will be collected at Ward's Island by means of intercepting sewers which will follow both banks of the Harlem river and the north shore of the Upper East river west of the Bronx river, and connect with Ward's Island by means of tunnels.

The sewage of that portion of Manhattan which drains to the Harlem river between 82d Street and 162d Street will be collected
11 at a point in Thomas Jefferson Park just south of the corner of Pleasant Avenue and 114th Street. The south intercepting sewer will run from 86th Street and East End Avenue northerly to its junction with the north intercepting sewer in Thomas Jefferson Park. In this park, near the water-front, the sewage from both of the interceptors will be passed through grit chambers and coarse screens, and will then be carried to Ward's Island by means of a deep tunnel bored through solid rock.

The sewage of all that portion of the Bronx which drains to the Harlem river and the Bronx Kills will be collected by an intercepting sewer starting at 192d Street and following as closely as practicable the easterly shore of the Harlem river at the corner of 132d Street and Willow Avenue. The dry weather flow from Marble Hill and the territory around Spuyten Duyvil will be brought by gravity into the existing Broadway sewer, while that from the low land west of Kingsbridge will have to be pumped into the sewer, which is to be intercepted at 192d Street.

The intercepting sewer along the Bronx shore of the Harlem river will receive also the dry weather flow from those areas in Manhattan north of 162d Street which drain to the Harlem river, with the exception of the sewage from a small district at the extreme northern end of the island which can be better served by having its dry weather flow pumped into a sewer at the corner of Seaman Avenue and Hawthorne Street, from which it would find its final outlet in the Hudson river at the foot of Dyckman Street. The sewage which is to be carried from Manhattan to the Bronx interceptor will be collected at 172nd Street and 201st Street by short intercepting sewers, passed through grit chambers and coarse screens and siphons under the Harlem river.

That portion of the Bronx west of the Bronx river which drains to the Upper East river will have its dry weather sewage flow collected by an intercepting sewer running from the vicinity of the Farragut Street sewer outlet at Hunt's Point to the corner of 132d Street and Willow Avenue.

At 132d Street and Willow Avenue, the sewage from the two Bronx intercepting sewers will be passed through grit chambers and coarse screens and then carried to Ward's Island by means of two deep tunnels of the same character as the one bringing the sewage from Manhattan to that place. It will be necessary to build only one of these tunnels in the near future.

As most of the area included in the Harlem Sub-division is either closely built up or is rapidly increasing in population, the collecting sewers have been designed by the commission to take care of the dry-weather flow that may ultimately be expected. The topography

and other conditions are such as to make adequate relief sewers expensive and difficult to construct.

12 Allowance in the estimates has been made for placing automatic regulators at the points in connection with the combined sewers, so as to control the flow into the interceptor from each sewer during period of storm. Allowance has also been made for the cost of such lateral sewers as will be necessary to bring to the main intercepting sewers the dry-weather flow from the outlets of the combined sewers. Most of the combined sewers are at such elevations that tide-gates will be required so as to prevent harbor water from entering the intercepting sewers; and tide-gates have been taken into account in estimating the cost of the project.

A pumping station will be located on Ward's Island, for the purpose of pumping all the sewage of the Harlem sub-division into the treatment tanks to be installed there. Final discharge of the clarified sewage will be through tunnels outletting into the East river opposite Ward's Island.

Collecting Sewers for the Eastern Bronx Sub-division.—The sewage from a large portion of the Eastern Bronx sub-division will be collected at Clason Point by a system of combined sewers now under construction. These combined sewers will be provided with storm-water overflows at various points along the Bronx river and Westchester creek.

In accordance with plans outlined by the Bronx Bureau of Sewers, another portion of this sub-division, lying east of Westchester creek, will be drained by a trunk sewer outletting at old Ferry Point; and the sewage of the remainder of the district, which drains to Eastchester bay, will be carried to an outlet on the south side of Throgs Neck.

A short intercepting sewer and a pumping station will be all that is required to transfer the dry-weather flow from the Old Ferry Point sewer to the sewer which is to discharge at Clason Point. At a later period, another intercepting sewer could be constructed along the water-front from the pumping station to a point near Throgs Neck, in order to intercept the dry-weather flow from the district draining to Eastchester bay. The cost of this sewer has not been included in the estimates, as it will not be necessary to build it in the near future at least.

The sewage thus collected at Clason Point, after passing through grit chambers and coarse screens, will be pumped to treatment works located at that place, and the effluent discharged through submerged outlets into the East river.

The sewage of the district draining to Eastchester bay will be discharged untreated into deep water in the East river close to the junction of the East river with Long Island Sound. If at some future time it is thought advisable to discontinue the discharge of raw sewage at this point, a connection can be made with the pumping station at Westchester creek, as previously mentioned; or treatment works can be installed in the vicinity of the outlet.

13 Collecting Sewers for the Northwestern Queens Sub-division.—The dry-weather flow from the Northwestern Queens Sub-division will be brought to the East river at the foot of Winthrop Avenue, Long Island City, by means of an intercepting sewer start-

ing on Ditmars Avenue north of Astoria Avenue, Corona, and running along the shores of Flushing bay and Bowery bay, passing thence through Steinway to its final outlet. The sewage will be passed through grit chambers and fine screens before being discharged.

With the street grades as now established, all the sewage of this area, with the exception of that from several small districts along the water-front, can be discharged into the East river by gravity. When these districts are developed, several small automatic pumping stations can be installed to pump the sewage into the main intercepting sewer. In order that the dry-weather flow from two large interior districts may be brought by gravity into the main interceptor, long dry-weather cut-off sewers will have to be constructed to intercept, at a considerable distance from the water front, the combined trunk sewers which are proposed for the drainage of these districts. The topography is such that these cut-off sewers can intercept the dry-weather flow from the combined lateral sewers which will connect with the main trunk sewers below the points from which the cut-off sewers start.

Preliminary drainage plans covering this territory have been prepared by the Queens Borough Bureau of Sewers and approved by the Board of Estimate and Apportionment. The plan proposed by the Commission interferes but little with any of the combined sewers proposed by the Bureau, except the main sewer along the water front, and affords a more favorable point for the discharge of the dry-weather flow. The storm water will be discharged directly into Flushing and Bowery bays. The main intercepting sewers along the shores of these two bays, as proposed by the Bureau of Sewers, becomes unnecessary. Steps have been taken by the Bureau of Sewers to build this sewer for the present only to a point on the southwesterly shore of Flushing bay, south of the outlet from Jackson Mill Pond. This sewer will continue to dispose of the storm water from the areas draining to the southwesterly shore of Flushing bay, while the dry-weather flow from the laterals discharging into it would be intercepted by the sewer proposed by this commission.

No satisfactory method of relieving the intercepting sewer for the Northwestern Queens Sub-division, at a reasonable cost, is apparent, and therefore this sewer has been designed by this commission to have sufficient capacity to provide for a dry-weather flow which is not likely to be exceeded for a great many years.

14 Collecting Sewers for the Corona-Flushing Sub-division.—

The house sewage from practically the whole Corona-Flushing Sub-division will be brought to Tallman Island by a main trunk sewer which will start in Winfield and run through Elmhurst and across the marshes, south and east of Corona, to Flushing creek. The sewer will pass under the street by means of a siphon and will follow the easterly bank of the creek through Flushing. From this point the sewer will cross the marsh to College Point and continue to Tallman Island.

The sewage from the tributary areas will be brought to the main sewer by many trunk and lateral sewers. One of the more important of these branch sewers will start near Forest Park and join the main trunk sewer on the meadows not far from Strong's Causeway.

Another, joining the main sewer just after it crosses Flushing creek, will drain the Mill creek valley and provide a much needed outlet for the dry-weather flow from the existing Ingleside trunk sewer. Still another sewer, with several main branches, will drain that part of Corona which lies north of the Long Island Railroad and, after passing under Flushing creek as a siphon, will join the main sewer at the corner of Broadway and Lawrence Street, Flushing.

Most of College Point will be drained by two trunk sewers, one of which will tunnel through the hill from the foot of Fifth Avenue, while the course of the other will be along the shore, serving the westerly and northerly portions of College Point.

After considerable study, it has been found feasible, with the street grades as established, and with the main sewer at reasonable depth, to collect practically all the sewage to Tallman Island without pumping. Some of the low land near the head of Flushing creek is so far from the main trunk sewer that its sewage will have to be pumped to that sewer.

At Tallman Island the sewage, after passing through grit chambers and coarse screens, will be pumped into the treatment tanks to be installed there. The clarified effluent will be discharged into the East river through submerged outlets at a considerable distance from shore.

Favorable conditions exist for the future relief of the main trunk sewer in this sub-division. This is fortunate, as the territory is very large, the main sewer long, and the present population scattered and comparatively small. The trunk sewers which will join the main sewers, and the main sewer itself west of Elmhurst, have been designed to serve populations which are not likely to be exceeded for many years.

A future relief sewer designed to start on the Queens Boulevard at Caldwell Avenue, southeast of Elmhurst, and run in an easterly direction, relieving the main trunk sewer of practically all the sewage which will flow into it from the south between Caldwell Avenue and Mill creek. This relief sewer will cross Flushing creek near Strong's Causeway and enter a pumping station to be built near the confluence of Mill and Flushing creeks. The Mill creek valley sewer will also be diverted so as to enter the station.

From the pumping station near the junction of Mill and Flushing creeks, the sewage will be lifted into a high level relief sewer which will flow through Flushing and follow the high land west of White-stone to the treatment works at Tallman Island. This future high level intercepting sewer will be continued, above its junction with the force main from the pumping station just mentioned, in a southerly and easterly direction through Flushing, Ingleside, and Flushing Heights. The sewage from the high land between the Mill creek valley and Cedar Grove Cemetery may be collected and siphoned across the lower end of this valley into the high-level sewer in Flushing.

The high-level relief sewers, just described, will deliver by gravity to the treatment works the sewage from practically all the high land of the Corona-Flushing Sub-division which lies east of Flushing creek.

The original main trunk sewer from Winfield to Tallman Island will be of sufficient size to carry the sewage which, for many years, may be expected to originate within the territory which will not be served in the future by the relief sewers, as described. It will be large enough, moreover, to carry the sewage from the whole Corona-Flushing Sub-division for a long time.

Collecting Sewers for the Northeastern Queens Sub-division.—The sewage from the Northern Queens Sub-division will be carried to Cryder's Point by two main intercepting sewers. One of these, the Whitestone intercepting, will start near the water west of Whitestone Point and run along the Whitestone shore and through Beechhurst to Cryder's Point. Near Whitestone Landing, a trunk sewer, draining a large inland district between Whitestone and Ingleside, will join the intercepting sewer.

The other main intercepting sewer will extend along the shores of Little bay and Little Neck bay, from Cryder's Point to a point in Bayside just north of Oakland Lake. At this place a trunk sewer will extend to the west, draining the large district between Ingleside and Bayside. At Broadway, in Bayside, the sewage from Douglaston, Little Neck, and the low land lying between Bayside and Douglaston, will be received into the main intercepting sewer through a force main which will run from an automatic, electrically-operated pumping station near Alley creek. To this pumping station the sewage from Douglaston and Little Neck will be brought by an intercepting sewer starting east of Douglas Manor and following closely the shore of Little Neck bay to the pumping station.

16 Practically all the sewage of the Northeastern Queens Sub-division, with the exception of that from Douglaston, Little Neck, and the low lands around Alley creek, can be brought to Cryder's Point, and there passed through screens and discharged into deep water by gravity. The sewage from a very small area near Whitestone Landing, and from several low-lying districts along the shore of Little bay and Little Neck bay, will have to be pumped into the high level sewers when the population on these areas becomes large enough to require sewage facilities. Also, a small marshy district near the city boundary, east of Douglas Manor, cannot be drained into the Douglaston intercepting sewer. These small districts will be served by inexpensive automatic pumping stations.

All the trunk and intercepting sewers of this sub-division, excepting the lower end of the intercepting sewer from Bayside to Cryder's Point, have been designed to serve a population which is not likely to be exceeded for many years. From Shore Avenue northward, it is proposed to relieve this sewer by a parallel sewer runing to Cryder's Point, but such a relief sewer will not be necessary for a long period.

Areas, Populations and Quantities of Sewage.

The following table gives, for the several sub-divisions, the areas, the estimated population and average dry-weather sewage flow upon which the design of the sewers was based, and the capacities of treatment works which the Commission has used as a basis for estimating the cost of the projects proposed for the Upper East River and Harlem Division:

Sub-division.	Area (without parks, etc.), acres.	Population.		Average dry- weather flow of sewage Mgd.		Capacity on treatment works on—	
		In 1910 from U. S. census.	In 1940 (esti- mated).	Which sewers are de- signed to carry.	Which sewers are de- signed to carry.	Which sewers are de- signed to carry.	Which sewers are de- signed to carry.
Harlem	12,100	905,300	2,105,800	2,838,000	124.4	302.2	200
Eastern Bronx	10,000	20,300	73,000	3.8	12.8	20
Northwestern Queens	3,100	10,000	28,500	253,000	0.5	5.0	15
Corona-Flushing	16,800	62,200	170,800	282,400	4.0	27.5	40
Northeastern Queens	5,000	8,000	22,000	62,800	0.3	4.5	10
Totals.....	48,500	1,100,800	2,410,000	133.0	352.0	285

17 Preliminary Estimates of Cost of Main Drainage Works.

The following table gives a summary of the estimated cost of construction and of the annual charges for maintenance and operation for the works suggested in this report. The costs of land and rights of way are not included.

Sub-division.	Cost of construction, including engineering.	Cost of maintenance and operation, in- cluding fixed charges.
Harlem	\$9,814,000	\$701,000
Eastern Bronx.....	708,000	87,000
Northwestern Queens.....	352,000	29,000
Corona-Flushing	1,961,000	154,000
Northeastern Queens.....	563,000	42,000
Total	<u>\$13,398,000</u>	<u>\$1,013,000</u>

(Here follows map of Proposed Sewer Disposal Project for Upper East River and Harlem Division.)

